Related Work

Fitts' Law is a core aspect that influences optimal control-display (CD) gain levels. It pertains to CD gain through its model for cursor movement time (MT) with respect to movement difficulty (MD), with two constants *a* and *b* that can be determined through linear regression – MT = *a* + *b*(MD) [6]. Fitts' Law was applied in the analysis of the effectiveness of various pointing devices, including a trackball mouse and touchpad [4]. The mouse was able to acquire targets much faster than the touchpad, more so as the difficulty to acquire the target increased [4]. Two experiments [2, 5] attempted to determine optimal CD gains with mice. One [2] was unable to determine an optimal gain, while the other [5] determined that gains of 2.4 for display movements of 40mm and 14.5 for display movements greater than 40mm minimized MT.

Those conclusions [5] raise the question of the effect display movement distance has on optimal gain. Lower control gains favor shorter distances and higher distances favor higher gains, given the reduced movement speed [10]. However, both longer movement distances and shorter movement times results in higher rates of overshooting the target [3].

Given that people of all ages are using computers and that people of different ages have different physical capabilities, it is useful to consider age when determining optimal gain. When studying the effects of various levels of gain on young adults (24 – 29 years) and the elderly (61 – 68 years) [7], however, it was discovered that both the young and elderly groups' optimal CD gain was 4, despite the elderly group's increased muscle activation when manipulating the mouse. When dealing with young children inexperienced with mouse use, no special considerations must be made. Children are just as capable with minimizing movement time at higher CD gains as young adults, but a gain of 4 facilitated the greatest accuracy [1]. Since all age groups' optimal CD gain is 4, it leads one to believe that no special considerations must be made for age.

It is important to consider the user's perception of the effect CD gain has on cursor movement. When using a stylus [8], users were most effective at matching their hand movement with cursor movement at very low gain levels (≤1). The minimum gain to retain that synthesis was .4 [8]. This is likely explained by the similarity the stylus has with the touchpad in terms of input method, which favors slow, precise movements [9]. With mice, however, users tended to prefer a gain of 4 [3].

References

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